

REMARKS/ARGUMENTS

Claims 11-28 are pending in the present application.

This Amendment is in response to the Final Office Action mailed August 8, 2006 and supports a Request for Continued Examination (RCE) filed concurrently. In the Final Office Action, the Examiner rejected claims 11-28 under 35 U.S.C. §102(e); and claims 11-28 under 35 U.S.C. §103(a). Applicants have amended claims 11, 15, 21 and 25. Reconsideration in light of the amendments and remarks made herein is respectfully requested.

Rejection Under 35 U.S.C. § 102

In the Office Action, the Examiner rejected claims 11, 12, 15-21, 25-28 under 35 U.S.C. §102(e) as being anticipated by U.S. Publication No. 2002/0063330 issued to Macris ("Macris"); claims 11-28 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,614,109 issued to Cordes et al. ("Cordes"); and claims 11, 15-21, 25-28 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,424,533 issued to Chu et al. ("Chu"). Applicants respectfully traverse the rejection and contend that the Examiner has not met the burden of establishing a prima facie case of anticipation.

1. Claims 11-12, 15-21, and 25-28:

Macris discloses a heat sink/heat spreader structures and methods of manufacture. A thermoelement couple comprises at least one heat absorbing junction 30 and two heat rejecting junctions 32 (Macris, paragraph [0113]). The heat absorbing junction is positioned near the center of the thermoelement face 28a and the heat rejecting junction 32 is positioned near the perimeter of the thermoelement face 28a (Macris, paragraph [0082]).

Macris does not disclose, either expressly or inherently, at least one of: (1) the thermoelectric film being located at a location matched to an area that needs thermal control, as recited in independent claims 11 and 21; (2) the thermoelectric film being fabricated on the opposite side of the bare wafer, as recited in claims 11 and 21; and (3) the thermoelectric film being selectively turned on or off by a power controller as recited in dependent claims 27 and 28.

First, Macris discloses the entire heat sink/spreader structure 56 acting as a thermoelement couple, not an individual thermoelectric film fabricated on a bare wafer or a substrate. The thermoelement couple is created through the bonding between a conductor or

semiconductor 28 to at least one dissimilar conductor or semiconductor 35 (Macris, paragraph [0113]). The thermoelement material 28 is provided in sheet form (Macris, paragraph [0081]). Therefore, the thermoelement couple is not a thermoelectric film fabricated on a bare wafer.

Second, Macris merely discloses the heat absorbing is positioned near the center of the thermoelement face 28a and the heat rejecting junction 32 is positioned near the perimeter of the thermoelement face 28a (Macris, paragraph [0082]). Since these locations are fixed with respect to the thermoelement material 28, they are not matched to localized areas that need thermal control as recited in claims 11 and 21.

Third, the two dissimilar semiconductor structures 37, 39 are bonded together at the heat absorbing junction 30 to yield a heat sink/spreader structure 26 (Macris, paragraph [0087]), not fabricated on an opposite side of a bare wafer.

Claims 11 and 21 have been amended to clarify an aspect of the invention wherein the thermoelectric film is fabricated on an opposite side of the bare wafer.

Regarding claims 27, and 28, the Examiner contends that the bare wafer 28 has power signal 22 to control the at least thermoelectric film, citing [0077] (Final Office Action, page 3, lines 9-10). Applicants respectfully disagree. The power leads 22 are used only to apply electric potential across the heat sink 12 and induces charge carrier flow 24 (Macris, paragraph [0077]), not to selectively turn on or off the thermoelectric film. The heat sink 12 is either powered or not powered by the power leads. There is no selectivity in turning on or off the heat sink 12.

2. Claims 11-28:

Cordes discloses a method and apparatus for thermal management of integrated circuits. An integrated thermo-electric cooler 510 having modules of p-type and n-type thermoelectric elements capable of cooling portions of integrated circuit 403 (Cordes, col. 7, lines 53-58). The thermoelectric cooler 510 is formed by forming n-type and p-type elements during the fabrication of the semiconductor device (Cordes, col. 5, lines 5-27; col. 6, lines 1-27; Figure 2C, element 328, 330, 358, and 360). A hot end 338 is assembled to cold end 301 (Cordes, col. 6, lines 30-31). Two p-type thermoelectric elements are made from a composition of $\text{Bi}_{0.5}\text{Sb}_{1.5}\text{Te}_{0.3}$ formed by a pulsed electrochemical deposition process wherein alternating layers of BiTe and SbTe of predetermined compositions form the desired composition of $\text{Bi}_{0.5}\text{Sb}_{1.5}\text{Te}_{0.3}$ (Cordes, col. 6, lines 5-11).

Cordes does not disclose, either expressly or inherently, at least one of: (1) the thermoelectric film being located at a location matched to an area that needs thermal control, as recited in independent claims 11 and 21; (2) the thermoelectric film being fabricated on the opposite side of the bare wafer, as recited in claims 11 and 21; and (3) the thermoelectric film being selectively turned on or off by a power controller as recited in dependent claims 27 and 28.

First, Cordes merely discloses fabricating the n-type and p-type thermoelectric elements as part of the composite semiconductor device fabrication. The thermoelectric elements 328, 330, 358, and 360 are sandwiched between the hot end 338 and the cold end 301 (Cordes, col. 6, lines 28-35; Figure 2C). Cordes, therefore, does not disclose a bare wafer and thermoelectric film on the bare wafer, and a substrate bonded to a die.

Second, the thermoelectric elements are not individual thermoelectric attached to the bare wafer or the substrate. They are fabricated using pulsed electrochemical deposition process or bulk plating process (Cordes, col. 5, lines 12, lines 14-15).

Regarding claim 17, Cordes merely discloses selecting a semiconductor substrate 302 to form a cold end 301 (Cordes, col. 4, lines 23-24), and a substrate 339 as a starting material to form a hot end 338 (Cordes, col. 5, lines 31-33). None of these substrates is thinned.

Regarding claims 27-28, the Examiner refers to Cordes, col. 6, lines 64-67. However, the cited excerpt merely states that “[p]roperly applying a DC voltage enables integrated thermoelectric cooler 310 to transfer thermal energy from the SOI integrated circuits formed in and onto layer 309.” (Cordes, col. 6, lines 64-67). The DC voltage does not selectively turn or turn off the at least thermoelectric film.

3. Claims 11, 15-21, 25-28:

Chu discloses a thermoelectric-enhanced heat spreader for heat generating component of an electronic device. A thermal dissipation subassembly includes a thermal spreader and at least a thermoelectric device (Chu, col. 2, lines 40-41; lines 47-51). The subassembly 25 includes multiple thermoelectric cooling units 30 embedded within openings formed in the thermal spreader plate 28 (Chu, col. 4, lines 66-67; col. 5, line 1).

Chu does not disclose, either expressly or inherently, at least one of: (1) the thermoelectric film being located at a location matched to an area that needs thermal control, as recited in independent claims 11 and 21; (2) the thermoelectric film being fabricated on the

opposite side of the bare wafer, as recited in claims 11 and 21; and (3) the thermoelectric film being selectively turned on or off by a power controller as recited in dependent claims 27 and 28.

Chu merely discloses the thermoelectric units 30 embedded in the thermal spreader plate 28 (Chu, col. 4, lines 66-67; col. 5, line 1), not fabricated on an opposite side of a bare wafer or a substrate. As shown in Figure 1 of Chu, the thermal spreader is located on top of the integrated circuit chip 14, not on the substrate.

In addition, Chu merely discloses providing electrical power to the thermoelectric units with power and ground connections (Chu, col. 4, lines 22-26), not a power controller to selectively turn on and turn off the units.

To anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Vergegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ 2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the...claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ 2d 1913, 1920 (Fed. Cir. 1989). Since the Examiner failed to show that none of Macris, Cordes, and Chu teaches or discloses any one of the above elements, the rejections under 35 U.S.C. §102 is improper.

Therefore, Applicants believe that independent claims 11 and 21 and their respective dependent claims are distinguishable over the cited prior art references. Accordingly, Applicants respectfully request the rejection under 35 U.S.C. §102(e) be withdrawn.

Rejection Under 35 U.S.C. § 103

In the Final Office Action, the Examiner rejected claims 11-28 under 35 U.S.C. §103(a) as being unpatentable over Chu in view of Cordes. Applicants respectfully traverse the rejection and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success.

Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *MPEP* §2143, p. 2100-129 (8th Ed., Rev. 2, May 2004). Applicants respectfully contend that there is no suggestion or motivation to combine their teachings, and thus no *prima facie* case of obviousness has been established.

Cordes discloses a method and apparatus for thermal management of integrated circuits as discussed above under the §102 rejection. Chu discloses a thermoelectric-enhanced heat spreader for heat generating component of an electronic device as discussed above under the §102 rejection.

Chu and Cordes, taken alone or in any combination, does not disclose, suggest, or render obvious, at least one of (1) the thermoelectric film being located at a location matched to an area that needs thermal control, as recited in independent claims 11 and 21; (2) the thermoelectric film being fabricated on the opposite side of the bare wafer, as recited in claims 11 and 21; (3) the thermoelectric film being selectively turned on or off by a power controller as recited in dependent claims 27 and 28; (4) the at least thermoelectric film is made by an alloy comprising at least one of bismuth (Bi), tellurium (Te), cesium (Cs), zinc (Zn), antimony (Sb), lead (Pb), silver (Ag), germanium (Ge), as recited in claims 12 and 22; and (5) the alloy comprises one of Bi and Te, Sb and Te, Zn and Sb, Te, Ag, Ge, and Sb, and Pb and Te, as recited in claims 14 and 23.

As discussed above under the 35 U.S.C. §102(e) rejections, neither Chu nor Cordes discloses (1) – (3) above. Accordingly, a combination of Chu or Cordes with any other references in rejecting any of the respective dependent claims such as claims 12, 14, 22, and 24 is improper.

Furthermore, Chu merely discloses embedding the thermoelectric units 30 in the thermal spreader and each thermoelectric unit includes an array of p and n type couples (Chu, col. 5, lines 19-21), not an alloy comprising at least one of bismuth (Bi), tellurium (Te), cesium (Cs), zinc (Zn), antimony (Sb), lead (Pb), silver (Ag), germanium (Ge). In addition, Cordes merely discloses two p-type thermoelectric elements are made from a composition of $\text{Bi}_{0.5}\text{Sb}_{1.5}\text{Te}_{0.3}$, not fabricating the thermoelectric film on a side of a substrate.

There is no motivation to combine Chu and Cordes because neither of them addresses the problem of fabricating a thermoelectric film on a side of a substrate. There is no teaching or

suggestion that such as thermoelectric film is present. Chu, read as a whole, does not suggest the desirability of using an alloy to fabricate a thermoelectric film on a side of a substrate. For the above reasons, the rejection under 35 U.S.C. §103(a) is improperly made.

The Examiner failed to establish a prima facie case of obviousness and the motivation to combine the references. When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to: (A) The claimed invention must be considered as a whole; (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination; (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and (D) Reasonable expectation of success is the standard with which obviousness is determined. Hodosh v. Block Drug Col. Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986). "When determining the patentability of a claimed invention which combined two known elements, 'the question is whether there is something in the prior art as a whole suggest the desirability, and thus the obviousness, of making the combination.'" In re Beattie, 974 F.2d 1309, 1312 (Fed. Cir. 1992), 24 USPQ2d 1040; Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 730 F.2d 1452, 1462, 221 USPQ (BNA) 481, 488 (Fed. Cir. 1984). To defeat patentability based on obviousness, the suggestion to make the new product having the claimed characteristics must come from the prior art, not from the hindsight knowledge of the invention. Interconnect Planning Corp. v. Feil, 744 F.2d 1132, 1143, 227 USPQ (BNA) 543, 551 (Fed. Cir. 1985). To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the Examiner to show a motivation to combine the references that create the case of obviousness. In other words, the Examiner must show reasons that a skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the prior elements from the cited prior references for combination in the manner claimed. In re Rouffet, 149 F.3d 1350 (Fed. Cir. 1996), 47 USPQ 2d (BNA) 1453. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or implicitly suggest the claimed invention or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." Ex parte Clapp, 227 USPQ 972, 973. (Bd.Pat.App.&Inter. 1985). The mere fact that references can be combined or

modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Furthermore, although a prior art device “may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so.” In re Mills 916 F.2d at 682, 16 USPQ2d at 1432; In re Fritch, 972 F.2d 1260 (Fed. Cir. 1992), 23 USPQ2d 1780.

In the present invention, the cited references do not expressly or implicitly suggest the thermoelectric film being made by an alloy comprising at least one of bismuth (Bi), tellurium (Te), cesium (Cs), zinc (Zn), antimony (Sb), lead (Pb), silver (Ag), germanium (Ge). In addition, the Examiner failed to present a convincing line of reasoning as to why a combination of Chu and Cordes is an obvious application of integrating thermoelectric elements into wafer for heat extraction.

Therefore, Applicants believe that independent claims 11 and 21 and their respective dependent claims are distinguishable over the cited prior art references. Accordingly, Applicants respectfully request the rejections under 35 U.S.C. §103(a) be withdrawn.

Conclusion

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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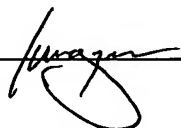
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